

REMARKS

The Examiner is thanked for the thorough examination of the application. No new matter is believed to be added to the application by this Amendment.

Election Restriction

The Examiner is thanked for withdrawing the restriction requirement and for examining all the claims of the present invention on the merits.

Status Of The Claims

Claims 1-30 are pending in the application. The claims have been amended to clarify their language.

Rejections Under 35 U.S.C. §112, Second Paragraph

1. Claims 2, 16, 17, 19, 20, 22 and 25 have been rejected under 35 U.S.C. §112, second paragraph as being indefinite. Applicants traverse.

In paragraph 4 of the Office Action, the Examiner asserts that the specific inventions in the claims are unclear and queries the meaning of the term “establishes”. However, the claims have been amended to clearly set forth the volume resistivity relationships, and the amended claims additionally do not use the term “establishes”.

Claims 2, 16, 17, 19, 20, 22 and 25 are thus clear, definite and have full antecedent basis. This rejection is overcome and withdrawal thereof is respectfully requested.

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2. Claims 10-13 have been rejected under 35 U.S.C. §112, second paragraph as being indefinite. Applicants traverse.

In paragraph 5 of the Office Action, the Examiner asserts that the term “low” in the recitation of “low-nitrile” is a relative term that renders the claim indefinite. However, this term is well known and would be recognized as such by one having ordinary skill in the art. As evidence thereof, please find attached a copy of page 238 of *The Handbook of Rubber Industry (Fourth Edition)* issued by the Society of Rubber Industry, Japan. An English translation of this excerpt is also attached. Table 3 in the translated excerpt clearly sets forth that low nitrile in NBR has no more than 24% of acrylonitrile. As a result, the concept of low nitrile rubber would be clear to one of ordinary skill.

Claims 10-13 are thus clear, definite and have full antecedent basis. This rejection is overcome and withdrawal thereof is respectfully requested.

3. Claim 10 has been rejected under 35 U.S.C. §112, second paragraph as being indefinite. Applicants traverse.

In paragraph 6 of the Office Action, the Examiner asserts that claim 10 lacks full antecedent basis. However, claim 10 has been amended to address any deficiencies in antecedent basis.

This rejection is overcome and withdrawal thereof is respectfully requested.

4. Claim 28 has been rejected under 35 U.S.C. §112, second paragraph as being indefinite. Applicants traverse.

In paragraph 7 of the Office Action, the Examiner asserts that claim 28 is unclear, and that the disclosure in the specification indicates that the salt is kneaded or blended with a polymer that will form a discontinuous phase. The Examiner's comments have been considered, and claim 28 has been amended to conform with the disclosure in the specification and in accordance with the Examiner's understanding of the invention.

Claim 28 is thus clear, definite and have full antecedent basis. This rejection is overcome and withdrawal thereof is respectfully requested.

Rejection Under 35 U.S.C. §103(a) Over Harada

Claims 1-30 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Harada (U.S. Patent 6,697,587). Applicants traverse.

The present invention pertains to a conductive member for use in an image-forming apparatus, formed from a conductive layer formed of a conductive polymer composition containing an ionic-conductive addition salt. Of the many embodiments of the invention, claim 1 typically combines components such that a discontinuous phase is formed from an ionic-conductive addition salt and a polymer that has a high affinity for the ionic-conductive addition salt.

Harada pertains to a semiconductive rubber composition. In Harada, the salt is present in the continuous phase. Harada fails to disclose a salt being present in the discontinuous phase.

In contrast, the present invention has the salt being present in the discontinuous phase. Therefore, in the present invention, even if an electric field is kept applied to the conductive polymer composition, the flow of the salt out of the discontinuous phase or out of the conductive polymer composition is suppressed. Thus, it becomes possible to obtain excellent conduction by addition of a small amount of the salt having a high conduction without separating out the salt to the surface or significantly increasing the electrical resistance. This aspect of the present invention is discussed in the specification at page 10, line 16 to page 12, line 20.

Also, when the polymer phase is composed of an electroconductive polymer composition containing an electroconductive filler such as carbon black, and the continuous polymer phase is composed of the ionically conductive polymer composition (such as in Harada), it becomes difficult to avoid variations in the electrical resistance value in the conductive member. This aspect of the related art is discussed in the specification at page 2, lines 2-24.

On the other hand, the present invention either uses a small amount of carbon black or does not use carbon black. That is, the present invention does not utilize electroconduction, such as in the technology of Harada. Therefore, the present invention can tolerate slight variations in electrical resistance inside the conductive member.

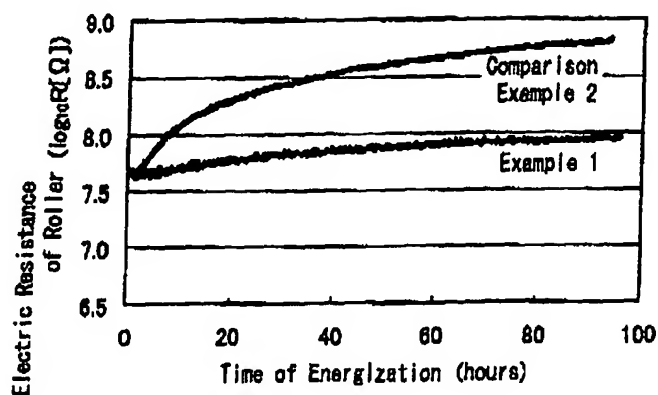
Further, at page 5, lines 10-12 of the Office Action, the Examiner admits to at least one failure of Harada: "Harada generally teaches the components of the instantly claimed invention with the exception that the salt taught by Harada is present in the continuous phase rather than the discontinuous phase as instantly claimed." The Examiner then asserts that this aspect of the

present invention would be obvious to one of ordinary skill. However, the Examiner has failed to point out where in the single reference of Harada itself resides the teaching or suggestion to have the salt in the discontinuous phase.

To establish a *prima facie* case of obviousness, “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” *MPEP* §2143. In addition, if a reference needs to be modified to achieve the claimed invention “there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion.” *Sibia Neurosciences Inc. v. Cadus Pharmaceutical Corp.*, 225 F.3d 1349, 55 USPQ2d 1927 (Fed. Cir. 2000).

As a result, one of ordinary skill in the art would not be motivated by the single reference of Harada to produce claim 1 of the present invention. A *prima facie* case of obviousness has thus not been made. Claims depending upon claim 1 are patentable for at least the above reasons.

Yet further, even if one assumes *arguendo* that the single reference of Harada is sufficient to allege unpatentability, this unpatentability would be fully rebutted by the unexpected results for the present invention. These unexpected results are typified by Figure 6 of the application, which is reproduced below.



Example 1 in Figure 6 is a polymer composition according to the present invention. Comparison Example 2 used a lithium salt capable of distributing to the continuous phase (*See* specification at page 90, lines 15-22). As shown in Figure 6, the electric resistance rose outstandingly during successive energizations in Comparison Example 2. In contrast, the resistance rose slightly in Example 1. As a result, Figure 6 demonstrates that there is a substantial difference in electrical resistance between the present invention and the related art typified by Harada. The unexpected results of the present invention are thus clear and fully rebut any unpatentability that can be alleged.

This rejection is overcome and withdrawal thereof is respectfully requested.

Information Disclosure Statement

The Examiner is thanked for considering the Information Disclosure Statement filed January 8, 2004 and for making the initialed PTO-1449 form of record in the application in the Office Action mailed September 19, 2006.

Prior Art

The prior art cited but not utilized by the Examiner indicates the status of the conventional art that the invention supersedes. Additional remarks are accordingly not necessary.

Foreign Priority

The Examiner has acknowledged foreign priority in the Office Action mailed September 9, 2005.

The Drawings

The Examiner is respectfully requested to indicate whether the drawing figures are acceptable in the next official action.

Conclusion

The Examiner's rejections has been overcome, obviated or rendered moot. No issues remain. It is believed that a full and complete response has been made to the Office Action. The Examiner is accordingly respectfully requested to place the application in condition for allowance and to issue a Notice of Allowability.

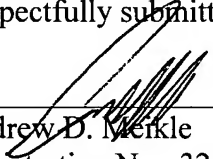
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

Dated: December 19, 2006

Respectfully submitted,

By


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Attachment: *Handbook of Rubber Industry* p. 238 and English Translation

Extract from "The Handbook of Rubber Industry (the forth edition)" issued by The Society of Rubber Industry , Japan

8.3.1 Nitrile content of NBR, HNBR

Acrylonitrile content of NBR is produced in the range of 15-53 mass%. Though there is no classification way standardized by nitrile content of NBR, generally it is being classified by being named as low nitrile, medium nitrile, medium high nitrile, high nitrile and very high nitrile from the order which the nitrile amount is small in (table 8-3).

Table 8-3 The name of NBR

Name	Acrylonitrile amount
Low nitrile	not more than 24%
Medium nitrile	25~30%
Medium high nitrile	31~35%
High nitrile	36~42%
Very high nitrile	not less than 43%

The number of NBR of the nitrile amount of 31~37% occupies 40% of the whole number of NBR in the market. The number of NBR of the nitrile amount of 33% is particularly large in the market, and it will be a standard kind.

With the increase in bound acrylonitrile of NBR, the oil-resistance improves, and the cold-resistance declines. Thus, there is a conflicting relationship between the oil-resistance and the cold-resistance.

The relationship between nitrile amount of NBR and that glass transition point is shown as the following numerical formula.

$$T_g = -85 + 1.4 A$$

A ; acrylonitrile amount

て、HNBRが得られる⁽¹¹⁾。

8.3 ニトリル系ゴムの種類

世界のNBR, HNBRの製造メーカーは、国際合成ゴム生産者協会(IISRP)に登録されている⁽¹⁾(表8-2)。

表 8-2 NBR の生産会社、国別、商品名⁽¹⁾

生産会社	国 名	商品名
日本ゼオン	日本	NIPOL
日本合成ゴム	日本	JSR
BAYER AG	ドイツ	PERBUNAN N
COPOLYMER RUBBER & CHEMICAL CORP.	アメリカ	NYSYN
DUTRAL S. R. L.	イタリア	ELAPRIM
GOODYEAR CHEMICALS EU-ROPE	フランス	CHEMIGUM
GOODYEAR TIRE & RUBBER	アメリカ	CHEMIGUM
HÜLS MEXICANOS, S. A.	メキシコ	HUMEX
KOMBINAT VEB, CHEMISCHE WERKE BUNA	ドイツ	BUNA
KOREA KUMHO	韓国	KOSYN
PETROCHEMICAL CO.	ブラジル	NITRIFLEX
NITRIFLEX S. A. INDUSTRIA E COMERCIO	ブラジル	NITRIFLEX
PASA PETROQUIMICA AR-GENINA, S. A.	アルゼンチン	ARNIPOL
POLYSAR ELASTOMERS	カナダ	KRYNAC
POLYSAR FRANCE S. A.	フランス	KRYNAC
SYNTHETICS & CHEMICALS LIMITED	インド	CHEMAPRENE
UNIROVAL CHEMICAL Co.	アメリカ	PARACRIL
USSR	ソビエト	SKN
ZEON CHEMICALS INC.	アメリカ	NIPOL
ZEON CHEMICALS EUROPE	イギリス	NIPOL, BREON

NBR, HNBRには乳重合SBRのように統一した製品の番号がなく、各社独自のナンバリングになっている。NBRは、そのポリマーのアクロニトリル量、ムーニー粘度、重合温度、添加された老化防止剤、第3モノマー成分、形状によって大別される。

HNBRはそれらに加え、水素化の度合いによって区別される。水素化の度合いは水素化率、 \equiv ウ素価、不飽和度によって表わされる。

8.3.1 NBR, HNBRのニトリル含有量

NBRのアクロニトリル量は、15-53重量%で生産されている。ニトリル量によるNBRの標準化した分類法はないが、一般的にニトリル量の少ないものを低・中・高・極高ニトリルと称し分類されている⁽²⁾(表8-3)。

市販されている品種数からみると、31-37%ニ

表 8-3 NBR の名称⁽¹⁾

名 称	アクロニトリル含有量
低ニトリル	25%以下
中ニトリル	25-30%
高ニトリル	31-35%
極高ニトリル	36-42%
	43%以上

リル量のNBRが全NBRの40%を占め、とりわけ33%含有のNBRが多く、標準的な品種としてよく知られる。

NBRの結合ニトリルの増大とともに耐油性・耐熱性が低下するという相反関係にある。NBRのニトリル量とガラス転移点との関係は、下の式で表わされる⁽³⁾。

$$T_g = -85 + 1.4 A$$

$$A: \text{アクリロニトリル量}$$

8.3.2 重合温度

NBRの重合温度は、5-50°Cの間が標準的で、25-50°Cで重合されたポリマーを高重合品、ホットラバーと称し、高強度・高弾力性となる。重合温度を高くすると、一般に重合速度は速くなるが重合度が上らなかつたり、ポリマーの架橋が増加し、加工性が劣るものになる。重合温度25°C以下のものを低重合品、ドラバーと呼ばれ、一般には10°C以下で重合する。

高重合品より弾力性、機械的強度がやや低くなるが、混練加工性、押出成型性、カレンダー加工などの加工性に優れるため、今では80%以上のNBRが低重合で生産されている。

8.3.3 NBR, HNBRのムーニー粘度

分子量3000程度の液状のものから、分子量10万までの重合度のもので生産されている。除くとポリマーのムーニー粘度で25から140の範囲が市販されている。ムーニー粘度の高いものは、強度、低圧縮永久ひずみのものが得られ、高圧用途に用いられたり、可塑剤が多量に添加された場合に、例えば、燃料油用途、インクロー用途などに多用される。可塑剤添加が少ない場合は、加工性がある。

ムーニー粘度の低いものは、高粘度品より物理特性が低くなるが、流動性に優れるため射出成型・カレンダー成型、押出成型などに多用される。

8.3.4 重合転化率

要求されるポリマーの性能と経済性のバランスによって、重合反応は所定の転化率にて停止される。

重合転化率を上げると、未反応モノマーの回収が難しくなり生産が上がる。しかし、ポリマー組成から見た場合、組成分布が広がったとき、押出加工時にポリマー分子の分岐や架橋が起こり、押出のダイスウェルが大きくなるなど、加工時のばらつきが大きくなる傾向にある。これらを総合的に判断して、NBRの転化率は60-90%が工業的に用いられている。転化率の低いポリマーの分子分布は、高いものそれと比較して狭い傾向にある。

ポリマー中の結合ニトリル量は、ブタジエンとアクリロニトリルの仕込み比率および重合転化率によって左右される。両モノマーの重合反応速度が異なる場合、重合中の各瞬間に生成するポリマー組成も変化する。

図8-2はアクリロニトリル仕込み量の異なる8種のNBRの反応進行過程で、各転化率において新たに生成するポリマー中のニトリル量の変化を示す。

図中のニトリル量37%の組成のポリマーが重合過程で一定の結合ニトリル量を示し、アゼオトロップ組成と一致する。

NBRの組成幅を均一にするため、重合系内のアクリロニトリル濃度を均一にするよう工夫されている。

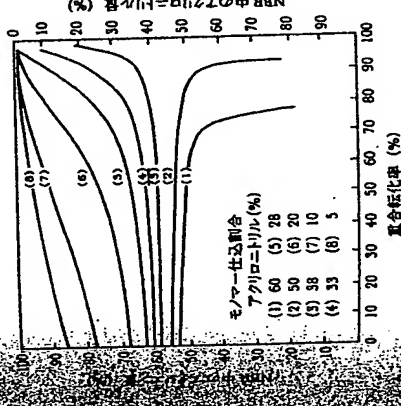


図8-2 重合中の各瞬間に生成するポリマーの組成 (重合温度 5°C)⁽¹⁾

8.3.5 老化防止剤

NBRの老化防止剤は、ポリマーの貯蔵中にムーニー粘度などの品質の変化が起きないように添加されている。

ヒンダードフェノールやリン系化合物が添加され、他と接触しても汚染しないので、非汚染性老化

防止剤として表示されており、全体の75%を占めている。

耐汚染性と表示されるものは、アルキルジフェニルアミンなどアミン系系老化防止剤が添加されており、非汚染タイプより貯蔵安定性、耐熱老化性が優れる。汚染老防を添加したポリマーは近年少なくなっている。

8.3.6 多元共重合体

NBRのアクロニトリル、ブタジエンの組み合わせに、第3のモノマーを加えた多元共重合体も広く知られている。代表的なものには、メタクリル酸、アクリル酸を三元共重合し、側鎖にカルボン酸を導入したカルボキシメタクリル共重合体で、XNBRと略称される。XNBRは通常のNBRと比較して、高強度で耐摩耗性の改善が著しい。しかし、スコーチ時間が短いので、過酸化亜鉛や表面処理した酸化亜鉛などの活性剤が用いられる^(14,15)。

NBRのブタジエン部分をインブレンに一部又は全部を代替したNBR, NIRが市販されており、明色配合の高強度・高伸びが特徴である。NBRの耐熱性を改良する目的で、ポリマー内に老化防止機能をもつアミノ基やフェニル基を含有したポリマーや⁽¹⁶⁾、NBRの二重結合部分を低減させるためにブタジエンの一部をアクリル酸エステルで代替した多元共重合体もある⁽¹⁷⁻¹⁹⁾。

更に第3モノマーとして、ジビニルベンゼンやエチレンジクロールジメタクリレートなどの多官能モノマーを用い、NBRの分子内で自己架橋しているタイプも市販されている。このポリマーの主たる目的は、押出成形やカレンダー成形などの加工時に、コンパウンドの収縮を少なくし、シート肌を良くするためである。

一般に自己架橋タイプのNBRは、通常のNBRと比較して引張強さや伸びなど物理的性質が劣るために、単独に使用されるよりもNBRの一部ブレンドされて用いられることが多い⁽²⁰⁾。

また、ポリ塩化ビニルやABS、ポリプロピレンなどの合成樹脂とブレンドされ耐衝撃吸収剤や非抽出可塑剤、軟化剤として用いられる。

波状ニトリルゴムの末端や、分子内に水酸基やフェニル基、カルボキシ基などが含まれたポリマーが市販されている⁽²¹⁾。これはエポキシ樹脂の硬化剤、改質剤に利用される。また、NBRの一部ブレンドして可塑剤の使われ方や、溶剤裂性の改良などに用いられる⁽²²⁾。

8.3.7 形状